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Laterite used as an additive

A North American Cement company has consulted WTW Americas Inc. to assist them in determining the flow ability and material handling needs of Laterite in their process.

Laterite is an old term for heavily weathered subsoil, rich in oxides of iron, aluminum, or both, ranging from reddish yellow to dark brownish red in colour. Because it hardens when subjected to wetting and drying, it can be cut, cured, and used as bricks. This hardening can also become a serious problem when handling or storing such a material in silos or stockpiles.

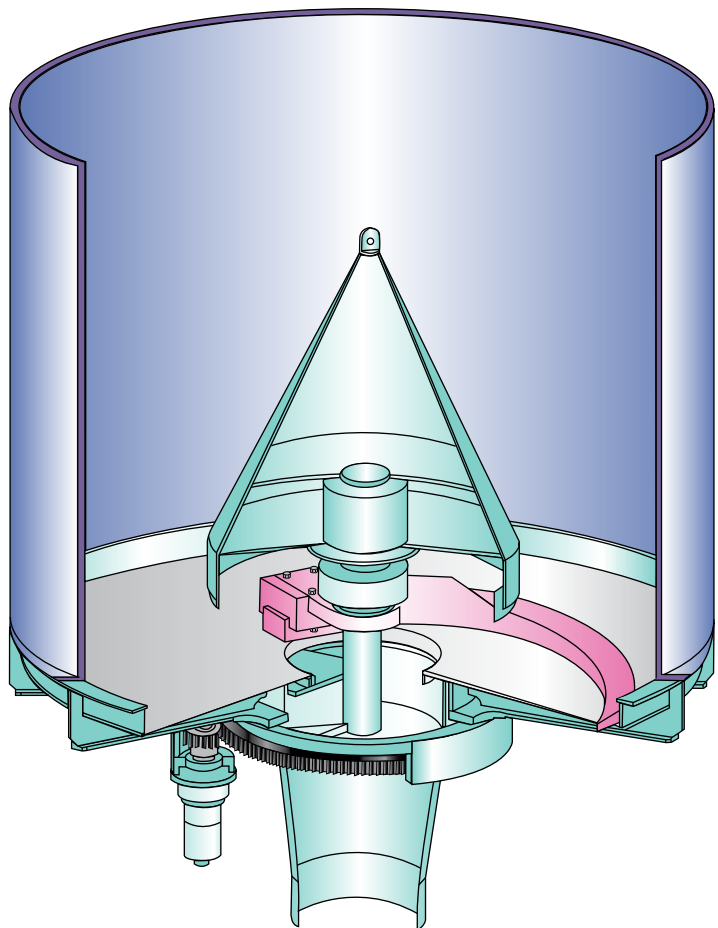
WTW Americas Inc specialises in non-free flowing bulk materials. Sticky, wet, cohesive, and abrasive materials are no match for their material handling equipment and experience. Equipment must be correctly selected to achieve proper plant layout and operations. The layout for the storage, conveying and reclaim systems must be individually matched according to the characteristics of the bulk material concerned, in order to ensure problem free material flow using practical designs.

Comprehensive material testing and analysis will determine the physical and mechanical properties and also the behaviour of the bulk material so that actual, rather than theoretical data can be used to determine the final equipment and plant layout.

WTW Americas tested the laterite to investigate its flow characteristics at various moisture contents, to simulate the rainy and the dry seasons. The two most important considerations for the desired mass flow are opening size and hopper angle (wall friction values). The lower the coefficient of sliding friction, the less steep the silo walls need to be to ensure mass

flow. Cohesive property tests were measured using the Jenike Shear Tester by determining the force it takes to slide a sample of material across a stationary wall surface. Cohesive property tests were also measured on the samples to determine their flow ability after being at rest for three days.

The tests indicate that the laterite will rathole in funnel flow. In funnel flow, some material moves while the rest remains stationary, allowing the formation of rat-



Right: WTW Americas Inc's rotary bin discharger (BinEX).

holes. This can lead to flow stoppages, stagnant material, segregation, flooding, etc. To avoid this situation, a mass flow pattern is recommended. In mass flow, whenever any material is withdrawn, all the material moves. This prevents ratholes from forming and provides a more positive flow pattern.

The simplified test results indicate the following is necessary to obtain mass flow:

Laterite moisture (%)	Time at rest	Conical opening to prevent arching (ft)	Slot opening to prevent arching (ft)
10	0	1.1	0.5
	72	1.3	0.6
15.4	0	0.0	0.0
	72	0.5	0.3
20	0	0.4	0.1
	72	0.9	0.4

Wall friction tests were run on 2B stainless steel and carbon steel to determine the hopper slopes for mass flow.

Moisture	Wall surface	Recommended conical hopper angle for mass flow (deg. from vertical)	Recommended wedge hopper angle for mass flow (deg. from vertical)
10	2B SS	22	32
	Carbon steel	21	32
15.4	2B SS	19	30
	Carbon steel	18	29
20	2B SS	0	10
	Carbon steel	6	16

BinEx - rotary bin discharger

Bulk compressibility tests were also run on each of the above mentioned samples to simulate the materials behavior in a bin. As the effective head of material is increased, the bulk density of the material also increases. The compressibility tests will also give a key indication about the materials cohesive strength and behavior. The resulting information from these series of tests have allowed WTW Americas Inc. to properly size all aspects of their rotary bin discharger (BinEX) to suit the cement plants needs based on storage, discharge rate, and accuracy.

The task of the central discharge unit BinEX is to extract wet, cohesive, sluggish or other non free flowing bulk material stored or buffered in silos.

The silo floor is an integral component of the BinEX system. It is flat with a circular discharge opening at its center. The undercut provided at the silo wall and the rotary movement of the discharge arm act together to prevent material build-up at the silo wall. The rotating

discharge arm conveys the bulk material towards the opening in the center of the floor and discharges it through this opening.

To prevent the bulk material from flowing out in an uncontrolled manner, the discharge opening is covered by an inner cone. The bottom of the inner cone has vertical adjustment plates. Adjusting these plates

allows the user to limit the slope of the bulk material and to increase or decrease the discharge volume per revolution of the arm.

The discharge arm passes underneath the inner cone and activates the entire silo bottom during the discharge operation, i.e. the discharge arm sweeps across the entire silo bottom during one rotation. One revolution of this specially curved and profiled arm extracts a uniform disc of material from the silo. Mass flow is therefore assured.

This keeps the bulk material column in motion and maintains its flow ability, preventing solidification of the bulk material over time and the risk of bridge formation inside the silo.

The BinEX rotary bin discharger is the ideal choice for reclaiming Laterite from a Silo. The BinEX is available in sizes of 1.5m in diameter up to 5m in diameter. Based on the cement plants needs, a 4m BinEX machine was designed with a mass flow guarantee.

